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$$=\frac{2\pi a^2b^3c^3\sin A}{\surd(\{4a^2c^2-[a^2+c^2-b^2]^2\}^3)}=\frac{\pi a^2b^3c^3\sin A}{32\surd(\{s[s-a][s-b][s-c]\}^3)}$$

$$=\frac{\pi a^2b^2c^2}{[4\text{ area of triangle}]^2}=\pi R^2.$$

CALCULUS.

160. Proposed by B. F. FINKEL, A.M., M.Sc., Professor of Mathematics and Physics, Drury College, Springfield, Mo.

A dog at the vertex of a right conical hill pursues a fox at the foot of the hill How far will the dog run to catch the fox, if the dog runs directly towards the fox at all times, and the fox is continually running around the hill at its foot, the velocity of the dog being 6 feet per second, the velocity of the fox being 5 feet per second, the hill being 100 feet high and 200 feet in diameter at the base?

Note by J. E. SANDERS, Hackney, Ohio.

The latter part of the solution given in the April MONTHLY is not correct. The dog cannot run towards the fox at all times and keep between the fox and the vertex of the hill. If we suppose only that he runs so that he is directly between the fox and the vertex, the following is the solution:

Let the surface of the hill be rolled out flat. Then the radius of the fox's path$=100\surd2$ feet$=a$. Put $n=\frac{5}{6}$, $s=$length of dog's path.

$$ds=[a/n]d\theta=\surd\{r^2+[dr/d\theta]^2\}.$$

$\therefore d\theta=\dfrac{ndr}{\surd[a^2-n^2r^2]}$, which gives $\theta=\sin^{-1}[nr/a]$ when integrated. When the dog catches the fox $r=a$, and

$\therefore\theta=\sin^{-1}n$ and $s=[a/n]\theta=120\surd2\sin^{-1}[\frac{5}{6}]=167.178$ feet.

No solution of Problem 165 has been received. See April number, 1903, page 115.

166. Proposed by T. N. HAUN, Mohawk, Tenn.

Find the volume of the solid formed by the revolution of the curve $[y^2+x^2]=a^2[x^2-y^2]$ round the axis of x.

Solution by G. B. M. ZERR, A. M., Ph. D., Professor of Chemistry and Physics, The Temple College, Philadelphia, Pa.

$$[y^2+x^2]^2=a^2[x^2-y^2].$$

$$\therefore y^4+2x^2y^2+x^4=a^2x^2-a^2y^2.\quad \therefore y^2=\tfrac{1}{2}\{a\surd[a^2+8x^2]-a^2-2x^2\}.$$

$$\text{Volume}=2\int_0^a \pi y^2dx=\pi\int_0^a \{a\sqrt{[a^2+8x^2]}-a^2-2x^2\}dx$$

$$=\pi\left[\frac{ax}{2}\sqrt{[a^2+8x^2]}+\frac{a^3}{4\sqrt{2}}\log\{\sqrt{[a^2+8x^2]}+2\sqrt{2}\,x\}-a^2x-\tfrac{2}{3}x^3\right]_0^a$$

$$=\frac{\pi a^3}{2}\left[\frac{1}{2\sqrt{2}}\log[3+\tfrac{1}{2}\sqrt{2}]-\tfrac{1}{3}\right]=\frac{\pi a^3}{2}\left[\frac{1}{2\sqrt{2}}\log[1+\sqrt{2}]^2-\tfrac{1}{3}\right]$$

$$=\frac{\pi a^3}{2}\left[\frac{1}{\sqrt{2}}\log[1+\sqrt{2}]-\tfrac{1}{3}\right].$$

167. Proposed by G. B. M. ZERR, A. M., Ph. D., Professor of Chemistry and Physics, The Temple College, Philadelphia, Pa.

Integrate, $\displaystyle\int_0^a\int_0^b\int_0^c \frac{zdxdydz}{(x^2+y^2+z^2)^{\frac{5}{2}}}$

Solution by the PROPOSER.

$$\int_0^a\int_0^b\int_0^c \frac{zdxdydz}{\sqrt{\{(x^2+y^2+z^2)^5\}}}=\tfrac{1}{3}\int_0^a\int_0^b\left[\frac{1}{\sqrt{\{(x^2+y^2)^3\}}}\right.$$

$$\left.-\frac{1}{\sqrt{\{(c^2+x^2+y^2)^3\}}}\right]dxdy$$

$$=\frac{b}{3}\int_0^a\left[\frac{1}{x^2\sqrt{(b^2+x^2)}}-\frac{1}{(c^2+x^2)\sqrt{(b^2+c^2+x^2)}}\right]dx$$

$$=-\tfrac{1}{3}\left[\frac{\sqrt{(b^2+x^2)}}{bx}+\frac{1}{c}\tan^{-1}\left(\frac{bx}{c\sqrt{(b^2+c^2+x^2)}}\right)\right]_0^a$$

$$=-\tfrac{1}{3}\left[\frac{\sqrt{(a^2+b^2)}}{ab}+\frac{1}{c}\tan^{-1}\left(\frac{ab}{c\sqrt{(a^2+b^2+c^2)}}\right)\right]+\infty=\infty$$

DIOPHANTINE ANALYSIS.

113. Proposed by L. C. WALKER, A.M., Professor of Mathematics, Colorado School of Mines, Golden, Col.

Find the four least integral numbers such that the difference of every two of them shall be a square number.

Solution by G. B. M. ZERR, A. M., Ph. D., Professor of Chemistry and Physics, The Temple College, Philadelphia, Pa., and J. A. SANDERS, Hackney, Ohio.

Let a, m^2+a, n^2+a, p^2+a be the numbers.

Then $p^2+a-a=p^2$, $n^2+a-a=n^2$, $m^2+a-a=m^2$, $p^2+a-n^2-a=p^2-n^2$, $p^2+a-m^2-a=p^2-m^2$, $n^2+a-m^2-a=n^2-m^2$.